

Title: Real-World Fractions!

Link to Outcomes:

- **Connections** Students will connect fractions, decimals, and percentages to real situations.
- **Problem Solving** Students will solve real-world problems integrating mathematics with other disciplines. They will do this both individually and cooperatively.
- **Communication** Students will communicate mathematically using oral and written language as well as technology.
- **Statistics** Students will collect, organize, graph, and interpret data.
- **Measurement** Students will apply concepts of measurement using standard customary units to interdisciplinary and real-world problem-solving situations.
- **Estimation** Students will estimate fractions, decimals, and percents in relationship to whole numbers and each other.
- **Reasoning** Students will demonstrate the ability to reason mathematically and justify their reasoning with examples.
- **Decision Making** Students will investigate, compare, and test data in order to make a logical decision.

Brief Overview:

This unit integrates consumer education and real-life situations with study of fractions. The activities in this unit are designed to reinforce equivalency in fractions and their relationship to decimals and percents. Upon conclusion of this unit, students should be able to apply their knowledge of fractions to the real world.

Grade/Level:

Grades 5/6

Duration/Length:

This activity may take 3 to 5 days, depending on the students' strengths in each area and which follow-up activities are chosen.

Prerequisite Knowledge:

- Students should be able to apply the four basic operations to fractions.
- Students should be able to explain the relationship between fractions, decimals, and currency.
- Students should be able to identify equivalent fractions.
- Students should be able to rename decimals to percents and percents to decimals.

Objectives:

- Use simulation and problem-solving strategies to solve a problem.
- Collect data to create charts and graphs.
- Use the basic operations to compute fractions and handle currency.
- Rename decimals, fractions, and percents to compare prices.
- Compare and order fractions and decimals to determine which is greater.
- Compute sales tax using decimals and percent.
- Utilize measurement skills to follow a recipe.

Materials:**Day 1**

Magazines and catalogs from which to cut pictures
Coupons (real or hand made)
Credit Limit Cards (Student Resource #1)
Shopping Receipt (Student Resource #2)
Calculators
Play money

Day 2

Recipe (per group) (Student Resource #3)
Recipe ingredients and utensils
Situation Stumper (per group) (Student Resource #4)
Fraction Cards (one card per group) (Student Resource #5)
Catering Cards (Student Resource #6)
Chart paper

Day 3

Objects for auction
Play money
Auction Name Cards (Student Resource #7)
Bidder's Tally Sheet (Student Resource #8)

Development/Procedures:**Day 1 "Shopping Spree"**

- Students will comparison shop various "stores" set up within their classroom. Students will apply their knowledge of addition, subtraction, percentages, fractions, and estimation to make smart consumer decisions while shopping for an imaginary party.

- The teacher will designate different areas of the room to be different stores that sell anything from groceries to shoes. You may use actual objects or may cut out pictures of objects from magazines, catalogs, or circulars. Make sure every object has a price assigned to it. It is a good idea to have the same or similar objects in two different “stores” with two different prices so the students may comparison shop. Make some items with sale prices, using both fractions and percents ($\frac{1}{2}$ off, 30% off, etc.). A coupon of bins for all the student consumers to choose from is also a great idea.
- Place students in three groups. Designate one group to be shoppers, one group to be cashiers, and one group to be change makers.
- Cut out and fill each credit limit card with a different amount of money that its owner can spend, as well as the number of guests for whom the shoppers may buy supplies. Be reasonable with the amount, for the cashiers and change makers will have to work with this amount of money. Consider a range of \$1 to \$5,000 each, and use amounts that will be easy to work with (for example: multiples of five and ten). After filling out the amounts, fold the cards and place them in a bucket, hat, etc., from which each student is to pull a card.
- To begin, ask each student to draw a card out of the hat. Explain that the goal of each shopper is to buy a sufficient amount of food and supplies for a specific event without going over the credit limit. The teacher then may choose to:
 - a. discuss the strategies of bargain shopping (such as comparing prices, understanding sales, reading the fine print, calculating 30% off a sale item, $\frac{1}{3}$ off etc.) **prior to** the students shopping ventures.
 - or
 - b. let the students shop **without** a preparatory lesson and see if they get into consumer trouble! Follow up the spree with a discussion to review and analyze what happened and discuss how to avoid certain pitfalls in shopping and budgeting.
- To begin shopping, let the students have an overall browse of the “stores,” and when they have an idea of what is available and what they want, let them begin shopping. Instruct the students as to how to fill out their shopping receipts. To “buy” an item, they must write the name of that item, the given price **per item**, how many of that item to be bought, and finally the total to spend on that item. The amount of time allotted for shopping should be clearly stated and posted at the start of the spree, so the students may pace themselves.
- After students feel they have bought all needed items without going over the designated limit, they must bring the receipts to the cashiers who (with a calculator) will add up the subtotals, figure out the tax according to that state’s guidelines, and fill in the totals. The students then must move to the change maker’s desk and give them credit limit cards. It is the change maker’s job to calculate how much change, if any, is owed to that consumer and to pay. Those students who go over their limits, have their cards voided and a record kept as to how over drawn they were. (The teacher may choose to give such students a second chance and incorporate a return policy).

- At the end of the spree, the cashiers must tally up how much money the stores earned, and the change counters must make sure their tills match that amount. Do they balance out? If not, where did the mistake arise? Discuss the measures of what happens when mistakes occur in real stores? How does theft and miscalculation lead to higher costs for the consumer?

Evaluation:

Students may be evaluated based on the following criteria:

- Did the students estimate and calculate well enough to avoid bankruptcy? The teacher may wish the students to show their calculations on an organized separate sheet of paper to monitor if they can correctly calculate percentages and fractions of dollar amounts.
- **Writing Activity** (See extension/follow up) Check for adherence to writing standards, creativity, and inclusion of persuasive writing techniques.

Extension/Follow Up:

Ask the students to gather data that shows what products were purchased the most, and what products were purchased the least. Graph the results. How would a store use such data?

As a possible extension that ties into language arts, music, and science, students may discuss the art of persuasive writing, advertising, and marketing in sales. A discussion may lead to the topic of the dangers of false advertising and misleading statistics, as well as, learning how to be a cautious consumer by reading “between the lines.” The students will probably enjoy discussing the advertisers use of music, smell, etc., as subliminal persuasions to subconsciously urge consumers to buy or use their products. A debate format could be used to argue whether or not such techniques are ethical. Also bring up how not too many years ago it was discovered that advertisers were sending subliminal messages through television and were banned and deemed as dangerous. Do they agree or disagree? Tie science in to investigate how the brain picks up subliminal messages and signals that our eyes do not. Finally, ask the students to bring in samples of ads, and compare and contrast them. Ask the students to create their own, either from an already existing product or from one they create on their own. Allow the students to choose what form of media they would like to use: pictorial, audio, or visual. All of these topics can be a great springboard for a unit on communication!

The game *Monopoly*® can be brought in at a later time so the students may again apply their budgeting/consumer skills as well as making and counting change. Briefly introduce the meaning of mortgaging.

- * A good source of literature to refer to during this lesson is the non-fiction book entitled The Kid's Money Book by Neale S. Godfrey, 1991.

Day 2 “Cooking Up Fractions!”

- **Warm Up Activity** Using Tomie de Paola’s The Popcorn Book, the students can estimate the number of kernels in a jar, then compare how the popcorn expands during cooking versus other foods, such as pasta. Ask the children how they would determine this? Does the weight of the popcorn and pasta increase after cooking? Discuss the relationship between heat and pressure!
- Students will review problem-solving strategies and procedures to determine equivalent fractions by applying those strategies to solve a puzzle and follow a recipe.
- Review with students problem-solving strategies followed by procedures for determining equivalent fractions.
- Place students in cooperative groups, about three per group.
- Place materials for Popcorn Pops recipe on front table. Place original recipe and catering cards on the board.
- Distribute to each team a copy of the “Situation Stumper” and one fraction card. It is all right for more than one group to have the same fraction card. The idea is to keep the cooking teams small.
- Referring to the original recipe, each team will look at the catering cards to decide the correct amount of guests it can feed if it were to complete the recipe according to the team fraction card. Each team will locate that correct number of guests on a catering card. For example:

“Our fraction card says double the recipe. The original recipe makes 24 pops. Therefore, if we double 24, we will have 48. So we can feed 48 guests. There’s a catering card that says 48 guests, so that’s our match!”
- After each team finds its match, discuss with students how they were able to identify the correct catering card for their team.
- Ask the students: “When we begin cooking, will each team use the same amount of ingredients? Why or why not?” The answer should be, “no,” since some will double the ingredients; some will use only half the ingredients; some will use $\frac{2}{3}$ of the ingredients, and so on.
- Allow students approximately fifteen minutes to calculate the amount of ingredients they need for their party and to prepare their Popcorn Pops accordingly.
- While the Popcorn Pops are hardening, each team will explain how it calculated the correct amount of ingredients to complete its recipe.
- Compare and chart the results. Did teams sharing the same fraction card come up with the same results? If not, why did the results differ? How did that affect the recipe?

Evaluation:

Students may be evaluated based on the following criteria:

- group participation and performance. Check for individual participation, sharing in the computations and calculations, and on-task behaviors.
- validity of their responses with logical reasoning and examples to back up those responses.
- proof of calculations on paper.
- **Writing Activity.** (See extension/follow-up activities.) Check for adherence to writing standards. Also check for logical reasoning and correct fractional computation within the activity.

Extension/Follow Up:

As a possible homework assignment, students may locate their favorite family recipes and write them on index cards. They can then design their own “situation stumpers” involving reasoning/problem-solving skills and equivalent fractions. The students should prepare to pose their “situation stumpers” to the class. Along with their problems, they must also provide a detailed solution sheet, using both word explanations and computations.

Further math/science extensions could be to discuss why certain recipes simply will not work if improper amounts of each ingredient are included. This branches into possible discussions of solubility vs. insolubility, temperature and boiling points, volume, ratios and proportions.

A social studies extension could be to research (tying in library and reference skills) which culture developed popping corn (also a possible lead into an inventors and inventions unit). Ask students to think geographically by researching and locating which states, countries, etc. produce the most corn. Draw or design a product map to share the findings. Discuss whose economy its production is boosting. Tie in science, yet again, by asking what effects weather has on this industry?

Many art projects can be created using popped corn and popcorn kernels. Make popcorn collages, popcorn jewelry, and, at Christmas time, make popcorn garlands!

Day 3

- Students will have a classroom auction as a culmination of the week’s activities. Instead of bidding for objects in dollars and cents, they will bid in fractions and percentages of dollars and cents.
- Collect either a variety of objects that students/parents/faculty would like to donate to the auction (old books, clothes, baked goods, etc.) or pictures of many different objects (you may want to use the pictures from the **Day 1** shopping spree). Set these objects/pictures in the front of the classroom.

- Give each student participating in the auction an equal amount of play money to use throughout the entire auction, along with a name card to hold in the air when making a bid (Name cards can be taped to the tops of rulers so they can be held up high).
- Choose one auctioneer and about two (human) calculators. The auctioneer is to hold up each object and request to start the bidding. The students in the audience may begin, but they must shout out their bids in terms of fractions or percentages of dollars.

For example:

Auctioneer: "Mr. Jones has baked a delicious devil's food cake. Who would like to start the bidding? John?"

John: "I bid $\frac{1}{4}$ of a dollar." (Meanwhile the human calculators are sitting alongside the auctioneer completing the Bidders Tally Sheet.

Auctioneer: "John bids $\frac{1}{4}$ of one dollar. Any other bids?"

It is now time when the other students will need to think how much $\frac{1}{4}$ of a dollar is, and then place a bid higher than $\frac{1}{4}$ of a dollar (in fractional/percentage terms) aloud if they choose. Since speed is a large part of the thrill of an auction, the teacher may want to allow the use of scrap paper, teams, or calculators to keep the children from getting frustrated and to move the process along.

Auctioneer: "Monica?"

Monica: "I bid 50% of one dollar."

Auctioneer: "We have 50% of one dollar (The human calculator lists Monica's name and 50% of a dollar.). Anyone else? Lisa?"

Lisa: "I bid $\frac{3}{4}$ of one dollar."

Auctioneer: "Lisa bid $\frac{3}{4}$ of a dollar. Do we hear one dollar? (He is now giving a hint as to how much Lisa bid. It is greater than 50% of one dollar but not over one dollar. This is where estimation skills come in as well as allowing the auctioneer to think mathematically, not simply shout out responses). No? Then $\frac{3}{4}$ of a dollar, going, going, gone, to Lisa!"

- Now the object is put to the side, and the human calculators can circle or highlight Lisa's name, her item, and winning bid. Continue the auction for either the amount of time you have designated in advance, or until all the items have been auctioned off. At the end of the auction, allow time for the human calculators to compute (with either scrap paper or calculators) how much each person owes in play money. Then have those who have purchased objects to come up and pay for them. If scrap sheets are used for computation, they may be collected and placed with the bidder's name on it in a folder along with the human calculators' receipts for teacher assessment.

Evaluation:

Students can be evaluated based on the following criteria:

- their ability to convert fractions to decimals and percents ($\frac{1}{4}$ equals 0.25 which equals 25%) and then apply them all in terms of money ($\frac{1}{4}$ of one dollar equals 25 cents).
- their ability to order fractions and decimals to know which is greater (for example, if the bid were $\frac{3}{4}$ of one dollar, they know they can not bid $\frac{2}{8}$ of one dollar or 50% of one dollar because both would be a decrease as opposed to an increase in bidding).

Extension/Follow Up:

A possible language arts extension could be to write a story from the point of view of one of the objects that were not auctioned off or the point of view of the object that sold for the highest amount of money. Another language arts activity could be to design a pre-auction guidebook that describes all of the objects that are going to be sold (a lesson on adjectives). The book can be merely objective and factual, simply stating the object, its age, etc. It can be descriptive and persuasive, which ties into the week's earlier lesson extension. This can branch out into a discussion as to whether or not there is a difference when an object is presented by the book or by the auctioneer. Is there an effect on how much the item sells for? This booklet can be typed on a computer to integrate word processing and graphics skills.

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- * The following are the literature sources already cited, plus a few more that also can easily be tied into this unit:

The Kid's Money Book by Neale S. Godfrey, 1991.

The Popcorn Book by Tomie de Paola. New York: Holiday House, 1978.

The Hungry Thing Went To A Restaurant by Jan Slepian and Ann Seidler. With this book you can incorporate money and problem solving. Create a menu, estimate prices, calculate meals, etc.

How The Second Grade Got \$8,205.50 To Visit The Statue Of Liberty by Nathan Zimelman. With this book, you can calculate and chart expenses, learn money management, etc.

How To Use Children's Literature To Teach Mathematics by Rosamond Welchman-Tischler through the NCTM (1992 edition).

The Multicultural Game Book by Louise Orlando through Scholastic Publications (1993 edition).

How My Parents Learned To Eat by Allen Say and Ina Friedman. MA: Houghton Mifflin Co., 1984. American girl explains how her parents met, each needing to eat through the other's culture.

Credit Limit Cards

Credit Limit Card

Name: _____
Limit: _____
Guests You Must Buy For:

Credit Limit Card

Name: _____
Limit: _____
Guests You Must Buy For:

Credit Limit Card

Name: _____
Limit: _____
Guests You Must Buy For:

Credit Limit Card

Name: _____
Limit: _____
Guests You Must Buy For:

Credit Limit Card

Name: _____
Limit: _____
Guest You Must Buy For:

Credit Limit Card

Name: _____
Limit: _____
Guest You Must Buy For:

SUB TOTAL _____
TAX _____
TOTAL _____
CHANGE _____

RECIPE: POPCORN POPS

Makes 24 Popcorn Pops

INGREDIENTS: 12 cups popped, salted popcorn
3 tablespoons butter
3 cups brown sugar
2 cups cold water
cooking oil or margarine
4 cups raisins (optional)

STEPS:

1. Put popcorn in a very large bowl. If you want to use raisins, mix them in with the popcorn.
2. Mix butter in a 2 to 3-quart pot. Add sugar and 2 cups of water to the pot. Stir until dissolved.
3. Boil the mixture, without stirring, for at least ten minutes. Have the remaining cup of cold water nearby to test the readiness of the syrup. If the syrup forms a thread when it drips from the spoon back into the pot, test the syrup by dropping a small amount into the cup of water to cool. With your fingers, gather up the cooled syrup. You should be able to form a soft ball that does not hold its shape. Keep testing the syrup until it reaches this point, then remove it from the heat immediately.
4. Pour the syrup slowly into the bowl of popcorn. Stir until all the popcorn is coated. Let the mixture cool.
5. Give each child a clean, dry ice-cream stick. Ask the children to coat their hands lightly with oil or margarine before they handle the popcorn mixture. Each child should take two handfuls of popcorn mixture to make a ball on the ice-cream stick.

SITUATION STUMPER

Hello owners of Klutz Catering. Today is the big day you have been waiting for! You are catering four parties throughout the area and have decided to prepare and serve your Impeccable Popcorn Pops at each occasion. The only difference in the preparation each time is that there are different numbers of guests per occasion, so the recipe must be altered accordingly. NO PROBLEM! You have already figured out how much you need to alter the recipe at each event so as to provide every guest with one Popcorn Pop. You even went as far as to jot down that information on separate index cards and handed them to the head chef at each kitchen.

Things are running smoothly, so you head out to the departing vans, cards in hand. But as you head out, you slip on some melted butter on the floor and drop all your carefully sorted index cards! They scatter everywhere! Now, with very little time to spare, you and your catering team must figure out which fraction card goes with which catered event! Good luck!

FRACTION CARDS

CUT THE RECIPE IN HALF

DOUBLE THE RECIPE

CUT THE RECIPE BY ONE
THIRD

USE TWO THIRDS OF THE
INGREDIENTS

CATERING CARDS

EVENT: Ms. Toth's Class Picnic

Guests: 16

EVENT: Camp Yahoo Dinner

GUESTS: 12

EVENT: Wilkins Wedding

GUESTS: 48

EVENT: Math Club Induction

GUESTS: 8

Auction Name Cards

_____ class auction. Admit one.
Name _____
Date _____

_____ class auction. Admit one.
Name _____
Date _____

_____ class auction. Admit one.
Name _____
Date _____

_____ class auction. Admit one.
Name _____
Date _____

_____ class auction. Admit one.
Name _____
Date _____

_____ class auction. Admit one.
Name _____
Date _____

_____ class auction. Admit one.
Name _____
Date _____

_____ class auction. Admit one.
Name _____
Date _____

Bidders Tally Sheet		
Item	Bidder	Bid